Use of Arm Span in Estimating Loss of Stature in Elderly Women with Low Back Pain in a Community

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Key words : Elderly women, Height, Arm span, Sitting height, Low back pain

Abstract

In the community setting, management of low back pain in elderly people is important, and performing simple physical measurements to estimate the amount of structural changes, including height loss, may be useful for screening purposes. Arm span can be used as a reference for the height attained before middle age. The purpose of this study is to compare (i) the estimated loss of stature, that is, arm span minus height (AS − H) and (ii) sitting height/arm span ratio (SH/AS) between elderly women with low back pain and asymptomatic women. Seventeen elderly women (age ≧ 60 years) with mild knee pain participated in this study. Analysis of covariance (ANCOVA) was used to compare the indications between the low back pain group (n = 10; age, 72.5 ± 4.6 years [mean ± SD]) and asymptomatic group (n = 7; age, 66.5 ± 4.5 years). Age-adjusted group mean of AS − H in the low back pain group (5.4 cm) was greater than that in the asymptomatic group (1.9 cm). The difference was statistically significant (p = 0.005). In contrast, no significant difference was found in SH/AS between the 2 groups for SH/AS (p = 0.123). The association between the loss of stature and etiological findings should be clarified.

Introduction

Low back pain is very common, especially in elderly people. It is associated with disabilities that require long-term care and high health care costs (Suka, 2008). Only some of these elderly people with low back pain visit hospitals for consultation. The others attempt to manage the condition on their own, and may therefore miss the opportunity for early detection of the etiology and better treatment of their symptoms. Therefore, the management of low back pain in elderly people in community settings is considered to be important. In community practices, simple physical measurements to estimate the amount of structural changes following or preceding low back pain may be useful for screening purposes.

As a person ages, there is a decrease in body height. The process of height loss is estimated to begin between 30 and 50 years of age (Sorkin, 1999). Arm span is a valid and reliable substitute for measuring height in frail older people (Nygaard, 2008). It can act as a reference of previous height and is a simple method to measure standing as well as sitting height. In our previous study in which young adult women were included as subjects, the height per arm span ratio was 1.006 on average (Tsuchida, 2008). This result was consistent with that of a study performed in other Asian nations, which revealed a clear association between height and arm span in young women (Manonai, 2001).

Low back pain may be responsible for structural changes in the spine that decrease the length of the spine. Compared to younger women, older women showed a decrease in height, as

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assessed using the arm span as the reference of previous height (Nygaard, 2008). If prolonged low back pain is responsible for decrease in body height, the loss of stature (with reference to previous height) in elderly people with low back pain may be greater than that in elderly people without low back pain.

The purpose of this study is to compare (i) the estimated loss of stature, that is, arm span minus height and (ii) sitting height/arm span ratio between elderly Japanese women with low back pain and elderly asymptomatic Japanese women.

Materials and methods

Subjects

A total of 17 elderly women aged 60 years or more participated in this study. All subjects were functionally independent and did not suffer from pain in the upper trunk and shoulders. We compared the characteristics of subjects with low back pain (low back pain group; n = 10; age, 72.5 ± 4.6 years [mean ± SD]) and without low back pain (asymptomatic group; n = 7; age, 66.5 ± 4.5 years). Low back pain was assessed using self-reported questionnaires. In the low back pain group, individuals with bilateral involvement (n = 7) were more than individuals with unilateral involvement (n = 3).

Measurements

Height and sitting height were measured with a digital height meter, which was accurate to 0.1 cm (Figure 1). Height was measured with the subject standing erect on a flat surface, barefoot, with the heels pressed together, head erect, eyes on the horizon, and arms hanging at the sides. Sitting height was measured with the subject sitting erect on a stool with hands resting on the thighs, feet touching the floor, head erect, and eyes on the horizon. To control the possible effect of rounding of the back, the subjects were encouraged to maintain a more upright rather than relaxed posture.

Arm span was measured with the subject standing with arms in the abducted position (Figure 2). A handmade 2-m-long ruler was used

A B

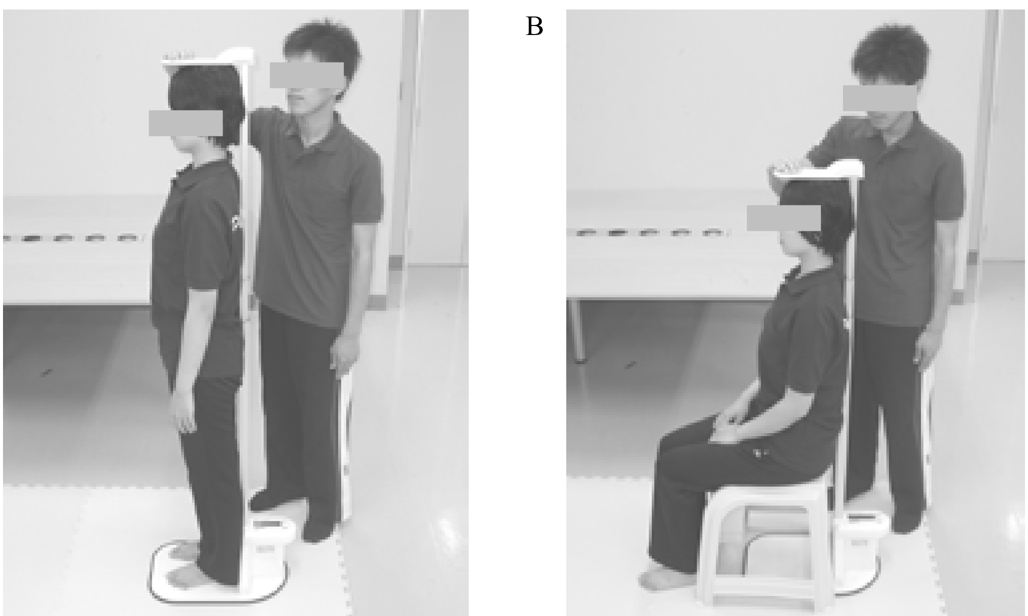

Figure 1. Measurements of height and sitting height
Height (A) and sitting height (B) were measured with a digital height meter.

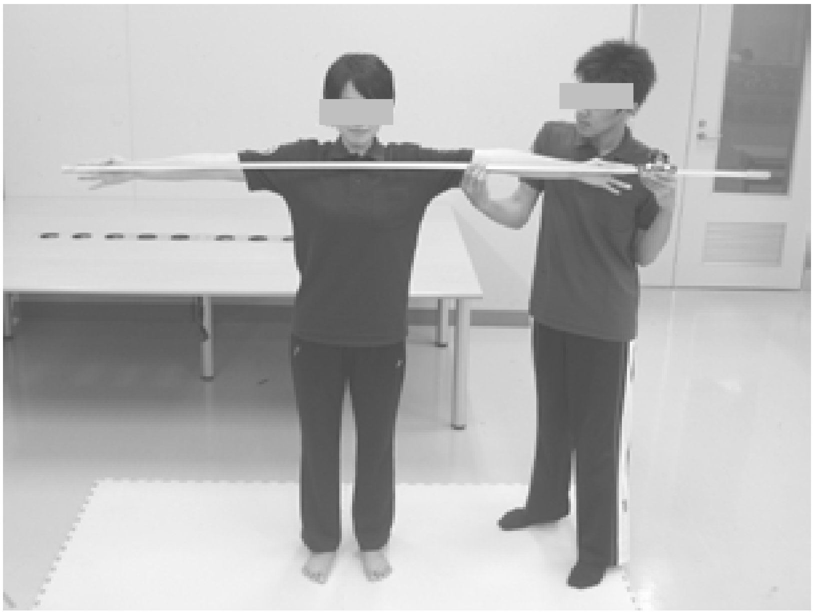

Figure 2. Measurement of arm span
Arm span was measured with the subject standing with arms in the abducted position. A handmade 2-m-long ruler was used for measuring the length between the tips of the middle fingers of the left and right hands.

for measuring the length between the tips of the middle fingers of the left and right hands. An L-shaped aluminum bar was used as the body of the equipment, on which a flexible metal tape measure with an adhesive tape on the back was attached. Particular care was taken to ensure that the arms were kept horizontally in line with the shoulders, and the subject was able to stretch them out straight. Measurements were made to the nearest 0.0 or 0.5 cm.

Arm span minus height (AS − H) and sitting height/arm span ratio (SH/AS) were calculated and used as the primary indicators. AS − H is a numeral value expressed in centimeters.

Statistics

Characteristics of the subjects in the 2 groups were compared using the Mann-Whitney *U* test or Student's *t*-test. Analysis of covariance (ANCOVA) was performed for comparison of the indications of the 2 groups, and age was used as a covariate for AS − H and SH/AS. Values of $p < 0.05$ were considered statistically significant.

Ethical Approval

This study was part of a larger trial carried out to elucidate the usefulness of physiotherapeutic intervention for community-dwelling elderly women with knee pain. The procedure was approved by the ethics committee of Niigata University of Health and Welfare in 2006. Participants provided written informed consent.

Results

With regard to the characteristics, no significant differences were found between the subjects of the 2 groups, except for their age: subjects of the low back pain group were significantly older than those of the asymptomatic group (Table 1). On comparing the indicators, we concluded that AS − H does differ between the 2 groups when adjusted for age (Table 2). The adjusted mean of

Table 1 Characteristics of the subjects

	Low back pain group (n = 10)	Asymptomatic group (n = 7)	p *
Age (years)	72.5 ± 4.6	66.6 ± 4.5	< 0.05
Weight (kg)	58.6 ± 6.9	59.2 ± 9.2	NS
Height (cm)	149.2 ± 4.6	151.2 ± 7.1	NS
Sitting height (cm)	79.7 ± 3.1	80.7 ± 2.7	NS
Arm span (cm)	154.2 ± 4.4	153.7 ± 8.4	NS

Mean ± SD; *Mann-Whitney *U* test or Student's *t*-test.

Table 2 Comparison of the 2 groups for AS – H and SH/AS

	Mean ± SD	Estimated mean*	p *
AS – H (cm)			
LBP (n = 10)	5.0 ± 1.4	5.4	0.005
Asymptomatic (n = 7)	2.5 ± 2.4	1.9	
SH/AS			
LBP (n = 10)	0.52 ± 0.01	0.52	0.123
Asymptomatic (n = 7)	0.53 ± 0.01	0.53	

AS – H, arm span minus height; SH/AS, sitting height divided by arm span; LBP, low back pain group; Asymptomatic, asymptomatic group.
* Analysis of covariance (ANCOVA), adjusted for age.

AS − H in the low back pain group was 5.4 cm and that in the asymptomatic group was 1.9 cm. The difference was statistically significant (p = 0.005). In contrast, no significant difference was found in SH/AS between the 2 groups (p = 0.123).

Discussion

We have demonstrated that arm span can be used in a community setting as a simple measurement for elderly Japanese women. To estimate the maximum attained height, we defined arm span as the distance between the tips of the middle fingers of the right and left hand with the arms outstretched. Various ways of measuring arm span have been proposed; demi-span was measured from the root of the ring finger to the sternal notch, and half arm-span was measured from the middle fingertip to the sternal notch (Hickson, 2003). Health-care staff may find our method easier to understand than other methods. However, attention should be paid to contractures or deformities, especially in individuals with thoracic kyphotic deformity or stiffness in the shoulder girdles. To minimize such influences, persons with pain in the upper trunk or shoulders were not included in this study.

This study revealed that the estimated loss of stature was greater in the low back pain group than in the asymptomatic group. The estimated loss was consistent with the averaged cumulative height loss reported by Sorkin et al.; the height loss for women between the ages of 30 and 70 years averaged approximately 5 cm, and by 80 years of age, it increased to 8 cm (Sorkin, 1999).

The extensive loss of stature we found in this study might be associated with kyphosis since kyphosis is one of the major clinical factors associated with height loss. A 15° increase in kyphosis was associated with a loss of more than 4 cm in height (Ensrud, 1997). It was also associated with vertebral fractures. New vertebral fractures, even those not clinically recognized, are associated with substantial increase in back pain and functional limitation due to the back pain (Nevitt, 1998). Another clinical risk factor for low back pain in women is lumbar spondylosis with narrowing of the disc space (Muraki, 2008). We regarded AS − H as one of the potential indicators in screening for underlying clinical factors.

Several possible explanations can be provided to account for the results of comparison of SH/AS between the 2 groups. One possible explanation is the effect of lower-limb alignment: knee malalignment was likely to exist due to knee pain in this study population. Measurement of lower-limb alignment should be included among the covariates as one of the confounding factors. Further research along this line will prove to be very valuable.

The limitations of this study are that the study population was small and that the mean age of the subjects differed between the 2 groups. Using a simple framework involving 2 groups means that the difference between means would be considered large if it is 80% of the standard deviation (assuming both groups have the same standard deviations) (Portney, 2009). Although age was a confounding factor when group means of the indicators were compared, the difference for AS − H (2.5 cm) was larger than either of the standard deviations of both the groups (1.4 and 2.4 cm) in this study. For further analysis, the sample size should be large enough to support the hypothesized interpretations of the indicators.

The association between the loss of stature and possible etiology should be clarified. Interpretations of the indicators should include underlying modifiable impairments so that improvement of the impairments can be evaluated in a community setting. After more clinical evidence is obtained, the indicators used in this study could be used in community practices for the management of elderly people with low back pain; this is because the assessment method is simple. In summary, we recommend that longitudinal studies that employ the same indicators should be performed with a larger number of participants.

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